Public

Locational Procurement

Proposed Market Design for Response and Reserve

NESO
National Energy System Operator

Purpose

NESO currently procures Response and Reserve Balancing Services on a national basis, with transmission constraints addressed closer to real time through operational processes, including the Balancing Mechanism. In July and November 2025, NESO published initial proposals for a locational procurement solution, through which the procurement of Response and Reserve services could better reflect regional network conditions and constraints.

NESO has now completed the proposed market design for locational procurement. This paper provides the detail of that design and explains how locational requirements and network constraints could be incorporated directly into the procurement of Reserve and Dynamic Response services. By allowing NESO to specify both national and local service requirements, and to avoid procuring capacity behind constraint boundaries, the proposed design aims to improve system security, reduce balancing and redispatch costs, and strengthen resilience.

This market design sets out the case for locational procurement in Dynamic Response and Reserve markets so that procurement outcomes better reflect the operational realities of the transmission network topology and forecasted constraints. Under the current national market design, the clearing process does not account for where services are located, which can result in Reserve and Dynamic Response being procured in areas where delivery is restricted by thermal or stability constraints, or where activation could worsen system conditions. As network constraints have increased in recent years, the existing procurement rules have led to inefficient procurement, higher real-time repositioning costs, reduced effectiveness of contracted services, and operational security issues. Therefore, the proposed design seeks to improve market efficiency by providing clearer locational signals for investment and participation, ensuring capacity is secured where it delivers the greatest operational value.

We would welcome industry feedback on the proposals before we complete our final design and proceed to the formal EBR Article 18 consultation.

Please review this Market Design and accompanying documents and provide any comments and feedback by Friday 3rd July 2026 via the following online form. If you have any questions, please direct them to commercial.operation@neso.energy.

- **Link to Feedback Form**

Supporting Documentation:

- Grid Supply Point to Zone Mapping
- 12 Zone GeoJson Map
- November 2025 Webinar Recording, Slidepack ,and Q&A

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Document History

Version	Publication Date	Changes
v1	May 2026	n/a

Related Documents

- For further information on the initial proposals, including supporting materials and webinar recordings, please refer to Enduring Auction Capability (EAC) webpage on the NESO website.
- Documents related to Dynamic Response and Reserve can be found online here. Of most relevance to this document are the Service Terms and Provider Guidance.

Glossary

ATC	Available Transfer Capacity, used to define the maximum transmission capacity between two defined adjacent zones for safe transfer of Reserve and Response Services.
Balancing Reserve (BR)	The purpose of this service is to manage energy imbalances at the day-ahead stage and reduce balancing costs.
Constraint Flows	It refers to the forecasted limits at constraint boundaries at day ahead stage. For further information, please refer to *Day Ahead Constraint Flows and Limits | National Energy System Operator*
Constraint Limits	It refers to the forecasted flows at relevant constraint boundaries at day ahead stage. For further information, please refer to *Day Ahead Constraint Flows and Limits | National Energy System Operator*
Dynamic Containment (DC)	A frequency response service delivered between 49.5-50.5 Hz, with a 1-second delivery time. Split into high- and low-frequency services (DCH and DCL). Mostly delivered outside of the 49.8-50.2 Hz range to contain frequency following a large fault.
Dynamic Moderation (DM)	A frequency response service delivered between 49.8-50.2 Hz, with a 1-second delivery time. Split into high- and low-frequency services (DMH and DML). Mostly delivered in the final 0.05 Hz in each direction, to provide a buffer against rapidly emerging imbalance.
Dynamic Regulation (DR)	A frequency response service delivered between 49.8-50.2 Hz, with a 10-second delivery time. Split into high- and low-frequency services (DRH and DRL). Delivered linearly across the range, to mitigate slowly emerging imbalance.
Dynamic Response (Dx)	The collective name for DC, DM and DR. The three services share a large portion of their service terms and are designed to work in concert.
GSP	It refers to Grid Supply Point, which is the connection between the Transmission System and a Distribution System. It is the point at which energy is taken from the Transmission System into the Distribution System.
GSP Group	It refers to one or more GSPs that, for the time being, are established as forming a Distribution System. There are 14 GSP groups in the UK, each responsible for a regional distribution services area.
Multi-zone Sharing	It refers to the ability for procured services in one zone to contribute to the requirements of another zone, where there is sufficient Available Transfer Capacity (ATC) between those zones.

Quick Reserve (QR)	This service is aimed primarily for reacting to pre-fault disturbances to restore the energy imbalance quickly and return the frequency close to 50.0 Hz. That is, it is used to keep frequency in the range between 49.8 and 50.2 Hz.
Slow Reserve (SR)	The purpose of this service is help recover frequency to operational range after a large loss and after DC delivery has been exhausted.
Sterilised Capacity	Sterilised capacity is procured capacity that cannot be used effectively in real time because network constraints prevent its delivery or would make its activation worsen a constraint.
System-wide Requirements (or GB-wide Requirements)	Also referred to as GB-wide Requirements. These are volumes of a certain service that NESO need to procure in the GB-wide system.
Zonal Max/Min Requirements	These are the maximum and minimum quantity of a service that can be procured from units located in a given zone or group of zones.
Zonal Requirements	Also referred to as locational requirements. These are the volumes of a certain service that NESO need to procure to be accessible for delivery in a given zone.

Market Design Overview

This market design extends the procurement rules for the Reserve and Dynamic Response market framework to incorporate network congestion constraints and locational information within the day-ahead procurement. The six Dynamic Response services (Dynamic Regulation High, Dynamic Regulation Low, Dynamic Moderation High, Dynamic Moderation Low, Dynamic Containment High and Dynamic Containment Low) and six Reserve services (Positive Balancing Reserve, Negative Balancing Reserve, Positive Quick Reserve, Negative Quick Reserve, Positive Slow Reserve, Negative Slow Reserve) are currently procured daily through a co-optimised day-ahead auction with a national requirement.

NESO proposes to introduce locational procurement into the day-ahead auction for these services, with the following key changes:

- The network will be divided into 12 zones aligned with key transmission boundaries.
- Providers will be required to submit locational information for each asset/unit to enable unit allocation to a single zone and Grid Supply Point (GSP) Group.
- All assets within an aggregated unit must be within the same zone and GSP Group and not cross zonal boundaries.
- NESO will not need existing providers to complete a full onboarding process again solely to provide locational information.
- NESO propose to use 'Available Transfer Capacity' (ATC) to define the maximum transfer capacity available between zones for both Response and Reserve services. NESO will share calculation examples ahead of go-live.
- Locational Procurement will apply differently to Reserve and Dynamic Response services, reflecting their different operational characteristics.
    - For Reserve services, NESO will set zonal requirements, with market clearing allowing requirements to be met through Multi-zone Sharing where feasible.
    - For Dynamic Response services, NESO will instead set Zonal Max/Min Requirements, without Multi-zone Sharing applied.
- NESO proposes to continue publishing system-wide requirements and, where appropriate, to publish Zonal Requirements and Zonal Max/Min Requirements.
- The clearing algorithm in the day-ahead auction will take ATC, system-wide and zonal requirements into account when accepting sell-orders in Response and Reserve auctions.
- In the case of active constraints across zonal boundaries, market clearing prices for the same service and in the same period might differ. However, for a given service and period, all units located in the same zone will be paid at the same clearing price.

Market Design

1 Zone Definition and Management

1.2 NESO proposes to implement a 12-zone model to procure Response and Reserve services in the electricity system across England, Wales and Scotland. The 12-zone model is proposed to align with the DFS 12-zone model – see Figure 1.

- The zones will be defined based on transmission constraints, market liquidity, and operational efficiency.
- As shown in the network diagram of Figure 1, Scotland is divided into three zones, and England and Wales into 9 zones.

1.3 NESO proposes that the defined zones will form the basis for assigning market units and for modelling transfer capacity between regions in the auction clearing algorithm.

1.4 The zone definitions will be reviewed periodically, for example every 2-3 years. Reviews may also be triggered by significant changes in network topology or constraint conditions.

1.5 If zone definitions need to be updated following a review, NESO will clearly communicate any changes to industry and work with affected providers to support the reallocation of impacted assets to the updated zones.

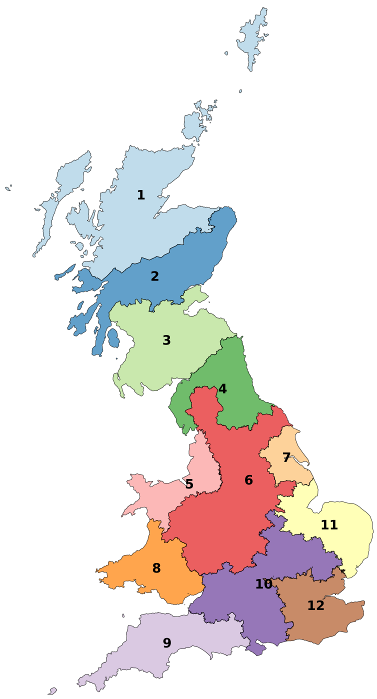

Figure 1 - A Simplified Network Diagram on a 12-Zone Model.

2 Unit Registration

2.1 All units involved in the relevant markets, including aggregated units, will be required to provide locational information as part of the current unit registration process.

- This information will continue to be subject to verification by NESO.
- This requirement applies to all assets assigned to a unit (including aggregated units comprised of multiple assets).

2.2 Each registered unit must be allocated to a single defined zone and a single GSP Group.

2.3 Assets within the same registered unit will not be permitted to span more than one zone or more than one GSP Group. Where this would otherwise occur, the assets must be split into separate registered units for participation.

2.4 The locational information submitted at registration will be assessed by NESO before pre-qualification to confirm that the unit's zone allocation has been correctly registered and that the relevant aggregation rules have been met.

3 Available Transfer Capacity

3.1 Available Transfer Capacity (ATC) is used to define the maximum transmission capacity between two defined adjacent zones for the safe transfer of Reserve and Response capacity across zonal boundaries.

- ATC will not be defined separately for each individual service.
- Instead, ATC will be shared across relevant services, and the clearing algorithm will allocate that transfer capacity in a way that maximises overall market welfare.

3.2 The calculation of ATC will be based on two factors: the Constraint Limits and Constraint Flows during the day-ahead stage. These figures are currently published daily by NESO. For existing Constraint Limits and Flow publications, please refer to *Day Ahead Constraint Flows and Limits | National Energy System Operator*.

- The Day-ahead Constraint Flows and Limits are published one day prior to delivery, showing the forecasted limits and flows within a 30-minute service window.
- For each constraint boundary, the limits are assessed and determined to ensure network loadings remain within permitted safety ratings and secured for a credible trip event considering all planned outages.
- Where relevant, the ATC calculation will also take account of operational support schemes or network arrangements that materially affect ATC in the relevant period.

3.3 NESO proposes to identify the operational process for deriving the final ATC values for use in the market auction, by converting limits and flows at constraint boundaries into ATC values across zonal boundaries.

- The aim is to accurately represent network constraints across zonal boundaries without being overly conservative or overstated.

3.4 Where no Transmission line exists between two adjacent zones, the ATC will be zero as capacity will not be able to flow directly between the two zones. Note - whilst not adjacent, zones 3 and 5 are connected via the Western Link and therefore will have an ATC under the right network conditions.

- Capacity procured in one zone may still contribute to requirements in another non-adjacent zone, provided that a feasible transmission path exists between the zones.

3.5 The implementation of ATC aims to improve procurement efficiency by enabling the market to distinguish between services located in deliverable and undeliverable areas of the network.

3.6 See Appendix 1 for a more detailed example.

4 Service Requirements

4.1 NESO proposes to specify both GB-wide (also referred to as system-wide) requirements and zonal requirements for each service and settlement period.

- These requirements include system-wide requirements for both Reserve and Dynamic Response, zonal requirements for Reserve, and maximum/minimum zonal requirements for Dynamic Response.
- Requirements will be developed for each service individually to ensure they accurately reflect its distinct operational characteristics.

4.2 A system-wide requirement is the volume of a certain service, that can be provided by units in any location on the GB system, subject to rules of the relevant service.

4.3 **Reserve Services**

4.4 For Reserve services, NESO proposes to specify a system-wide requirement and a zonal requirement for each service and settlement period.

- The system-wide requirement will remain the same as the current approach to day-ahead buy-orders.
- The zonal requirement will be a new input provided by NESO in the day-ahead process to produce buy-orders.
- Reserve services will not require minimum or maximum procurement limits by zone as required for Response.

4.5 The methodologies used by NESO to generate zonal requirements for each Reserve service may be different as each service is designed to cover a specific system need.

4.6 A zonal requirement is the volume of a certain Reserve service, that must be accessible to a given zone in each settlement period.

- A zonal requirement can be met by procurement within that zone.
- A zonal requirement may also be met by units in other zones where sufficient ATC exists to support delivery.

Response Services

4.7 For Response services, NESO proposes to specify a system-wide requirement and a maximum/minimum zonal requirement for each service and settlement period.

- The system-wide requirement will remain the same as the current approach to day-ahead buy-orders.
- The maximum/minimum zonal requirements will be a new input provided by NESO in the day-ahead process to produce buy-orders. They specify the minimum and maximum procurement limits by zone or by group of zones.

4.8 The detailed methodology for setting zonal minimum and maximum requirements for Dynamic Response services is proposed to be developed separately for each service.

- This methodology is proposed to consider factors, such as zonal demand, inertia, expected boundary capacity and stability limits.

4.9 Maximum and Minimum Zonal Requirements will be used for a certain Dynamic Response service to constrain the quantity of a service procured from a particular zone.

5. Auction Clearing and Pricing Rules

Auction Clearing Algorithm

5.1. The day-ahead auction is proposed to be cleared by co-optimising all service sell orders with the objective to maximise total social welfare, subject to the network constraints and system requirements.

- These service requirements include system-wide and zonal requirements and minimum or maximum zonal limits.
- The network constraints are represented by Available Transfer Capacity (ATC) between zones.

5.2. When clearing the auction, the clearing algorithm is proposed to consider both the location of services and the ATCs between zones.

- Therefore, the clearing process will recognise that the operational value of a service depends on both where it is located and the bidding prices.

- As a result, the algorithm may accept a higher-priced offer in one zone ahead of a lower-priced offer in another zone where the lower-priced offer would not provide the same value due to being constrained by network conditions.
- The clearing algorithm will also allocate the transfer capacity in a way that maximises overall market welfare and in doing so, optimises the use of the available network resources.

Pricing Algorithm

5.3. The auction is designed to allow different zones to clear at different prices for the same service within the same settlement period where a zonal boundary limit is reached.

- In fully unconstrained conditions across all zones, the same service will be cleared at a common price across all zones.
- Where constraints are active, the value of procuring the service will differ by zone, and clearing prices will also differ by zone.
- This price differentiation is intended to reflect the varying operational value of services in different parts of the network, given the uneven network constraints.

5.4. NESO proposes that for a given service, settlement period and zone, all accepted units in that zone will receive the same clearing price.

- This means that the clearing pricing will remain uniform at a zonal level for each service and settlement period.

Multi-Zone Sharing for Reserve Services

5.5. NESO proposed to apply multi-zone sharing exclusively to Reserve services. It refers to the ability for Reserve capacity procured in zone A to satisfy the reserve requirement in both Zone A and Zone B simultaneously, to the extent that there is sufficient ATC between two zones. (See Appendix 1 for examples)

- Multi-zone sharing is designed for situations where zonal requirements are driven by events that are not expected to occur at the same time across different zones, allowing shared capacity to be used efficiently.
- This approach will apply only to Reserve services and not to Dynamic Response services, reflecting the different methodologies used for setting Zonal Max/Min Requirements of Dynamic Response services, as well as their distinct operational characteristics.
- The extent to which services can be shared between zones will be limited by the ATC.

5.6. Multi-zone sharing is proposed to be bi-directional.

- This means that, within the same settlement period, the procurement in one zone may contribute to the requirement of another zone, while also receiving support from that zone for a different requirement, if there are sufficient ATCs in both directions.

- Under multi-zone sharing, the total procurement can be lower than the sum of all individual zonal requirements, while still meeting system needs because the same capacity procured for multiple zones is unlikely to be required simultaneously across those zones.

5.7. As previously noted in the ATC section above, where no Transmission line exists between two adjacent zones, the ATC will be zero as capacity will not be able to flow directly between the two zones. However, this does not inhibit Multi-Zone Sharing as capacity can be shared via alternative zones and under the right network conditions.

- Capacity procured in one zone may still contribute to requirements in another non-adjacent zone, provided that a feasible transmission path exists between the zones.
- For example, capacity may be transferred from Zone 1 to Zone 3 via Zone 2(i.e. Zone 1 → Zone 2 → Zone 3), provided sufficient ATC exists on each segment of the path.

5.8. Multi-zone sharing is proposed to support a more efficient use of Reserve resources.

- This is expected to reduce unnecessary procurement, improve the value of contracted services, and support more efficient market outcomes.
- This supports better procurement outcomes, while still maintaining an appropriate level of system security, than a purely zonal approach in which each zone would need to procure its full requirement independently.

Appendix

Appendix 1: Multi-zone Sharing Example

The following demonstration takes Slow Reserve as an example to show how multi-zone sharing works. In this example, Zone 1 needs 1000 MW as that is the largest loss in that Zone. The local requirement in Zone 2 is 900 MW. The system-wide requirement only needs to be available in Zone 1. The ATC is 500 MW in both directions.

Table 1 SR Requirements

Type	Zone	Quantity(Q)
System-wide		1000
Local	1	1000
Local	2	900

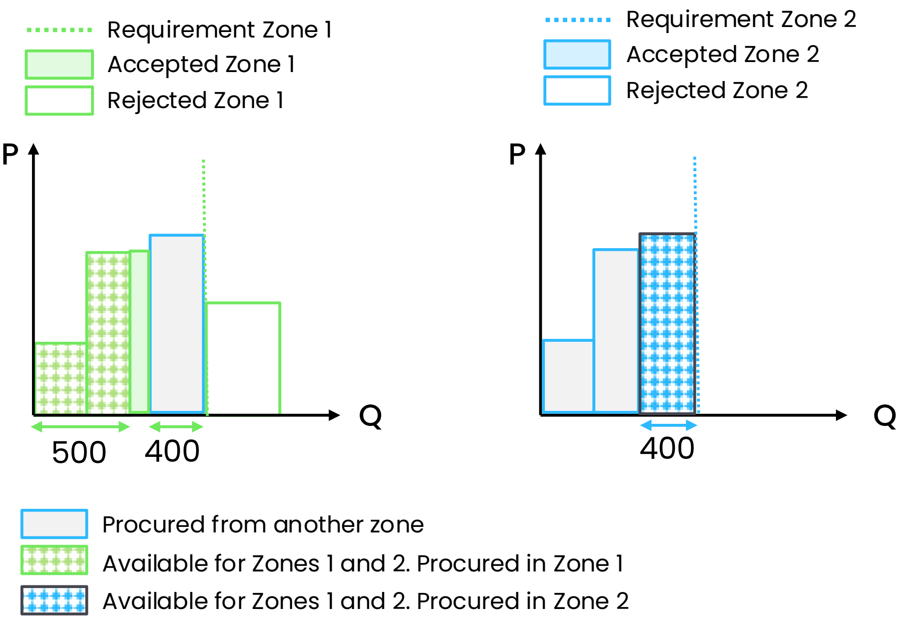

Figure 2 - Numerical example of Sharing

Given that "sharing" of SR is allowed between zones, the optimal solution could be to accept the local supply of 400 MW in Zone 2 (to satisfy the local requirement of 900 MW, with a maximum sharing of 500 MW from Zone 1), and accept 600 MW of local supply in Zone 1 (to satisfy the local requirement of 1000 MW, with 400 MW already shared from Zone 2).

If the largest fault in Zone 1 occurs, 400 MW could flow from Zone 2, as there is sufficient ATC. Conversely, if the largest fault in Zone 2 occurs, 500 MW could flow from Zone 1.

The total procurement can be computed by the formula, which yields:

$$\textit{Total Procurement} = 1000 + 900 - 500 - 400$$

$$\textit{Total Procurement} = 1000 \text{ MW}$$

The total procured SR is 1000 MW, which is less than the sum of the local requirements for each zone (1900 MW).

It is important to highlight that sharing can be bi-directional. Indeed, Zone 1 shares 500 MW with Zone 2 and Zone 2 shares 400 MW with Zone 1.

Furthermore, as shown in Figure 2, the cheaper bid of Zone 1 is not accepted before the more expensive bid in Zone 2 is accepted. This is because there is congestion from Zone 1 to Zone 2. In other words, the cheaper bid in Zone 1 would be sterilised by insufficient ATC from Zone 1 to Zone 2.